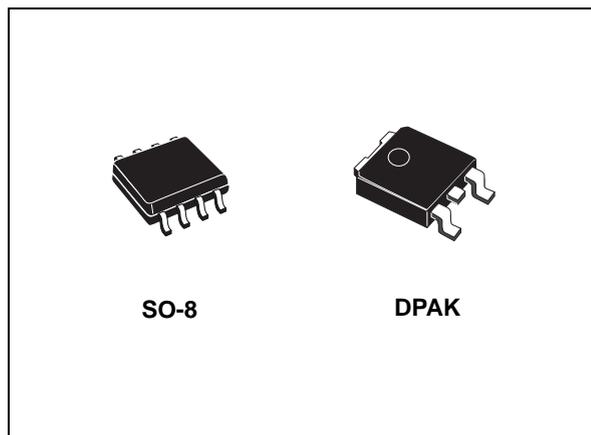


## Very low drop voltage regulators with inhibit

Datasheet - production data



### Description

The KF series are very low drop regulators available in SO-8 and DPAK packages and in a wide range of output voltages.

The very low dropout voltage (0.4 V) and the very low quiescent current make them particularly suitable for low noise, low power applications and especially in battery powered systems.

A shutdown logic control function is available (pin 5, TTL compatible). This means that when the device is used as a local regulator, it is possible to put a part of the board in standby, decreasing the total power consumption. It requires only a 2.2  $\mu\text{F}$  capacitor for stability allowing space and cost saving.

### Features

- Very low dropout voltage (0.4 V)
- Very low quiescent current (typ. 50  $\mu\text{A}$  in OFF mode, 500  $\mu\text{A}$  in ON mode)
- Output current up to 500 mA
- Logic-controlled electronic shutdown
- Output voltages of 2.5; 3.3; 5; 8 V
- Internal current and thermal limit
- Only 2.2  $\mu\text{F}$  for stability
- Available in  $\pm 2\%$  accuracy at 25  $^{\circ}\text{C}$
- Supply voltage rejection: 70 db (typ.)
- Temperature range: - 40 to 125  $^{\circ}\text{C}$

**Table 1. Device summary**

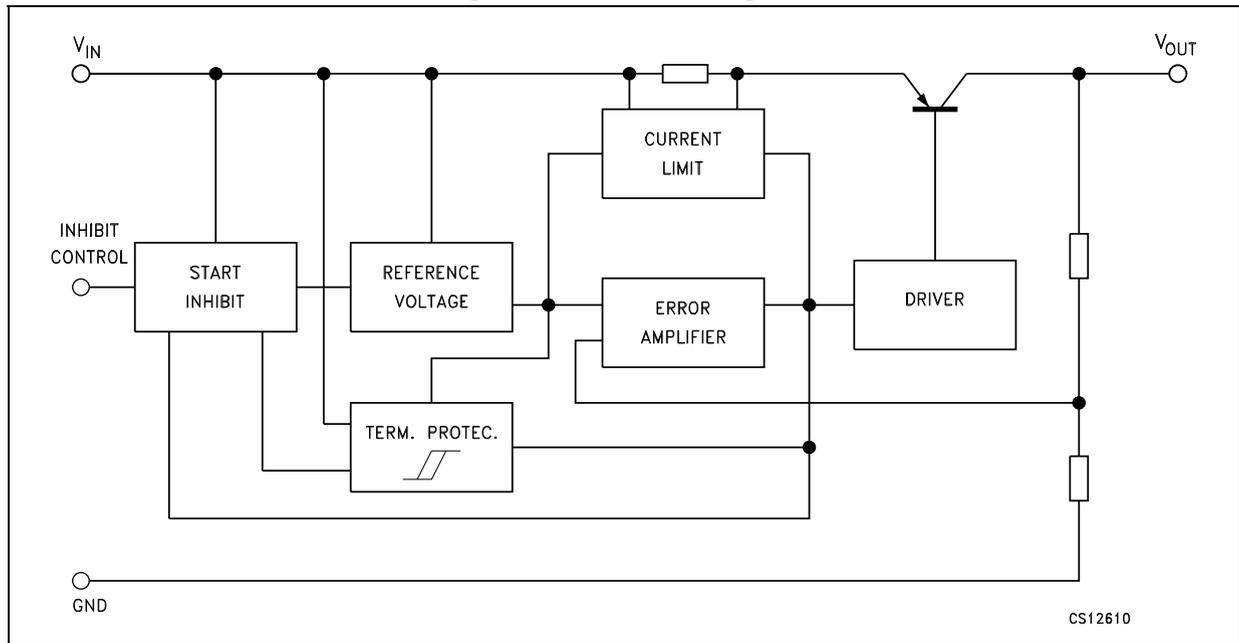
| Order codes          |                      | Output voltages |
|----------------------|----------------------|-----------------|
| SO-8 (tape and reel) | DPAK (tape and reel) |                 |
| KF25BD-TR            | KF25BDT-TR           | 2.5 V           |
| KF33BD-TR            | KF33BDT-TR           | 3.3 V           |
| KF50BD-TR            | KF50BDT-TR           | 5 V             |
|                      | KF80BDT-TR           | 8 V             |

# Contents

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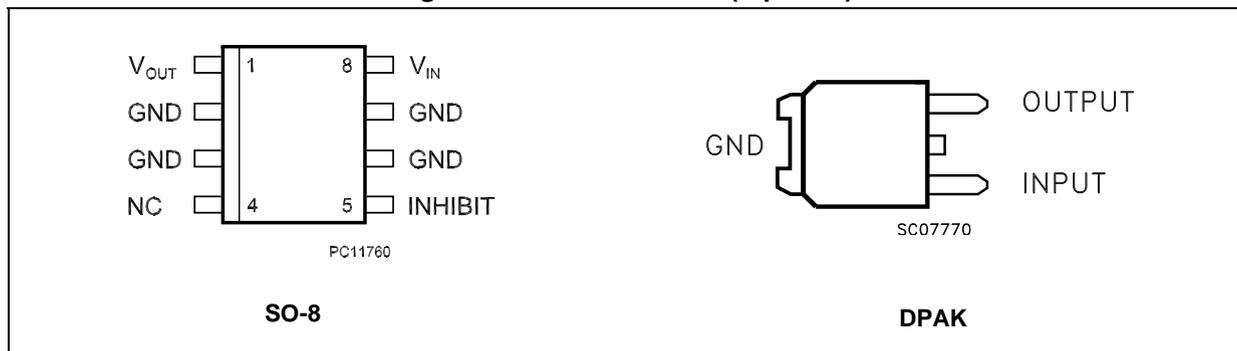
# 1 Diagram

Figure 1. Schematic diagram



## 2 Pin configuration

Figure 2. Pin connections (top view)



### 3 Maximum ratings

Table 2. Absolute maximum ratings

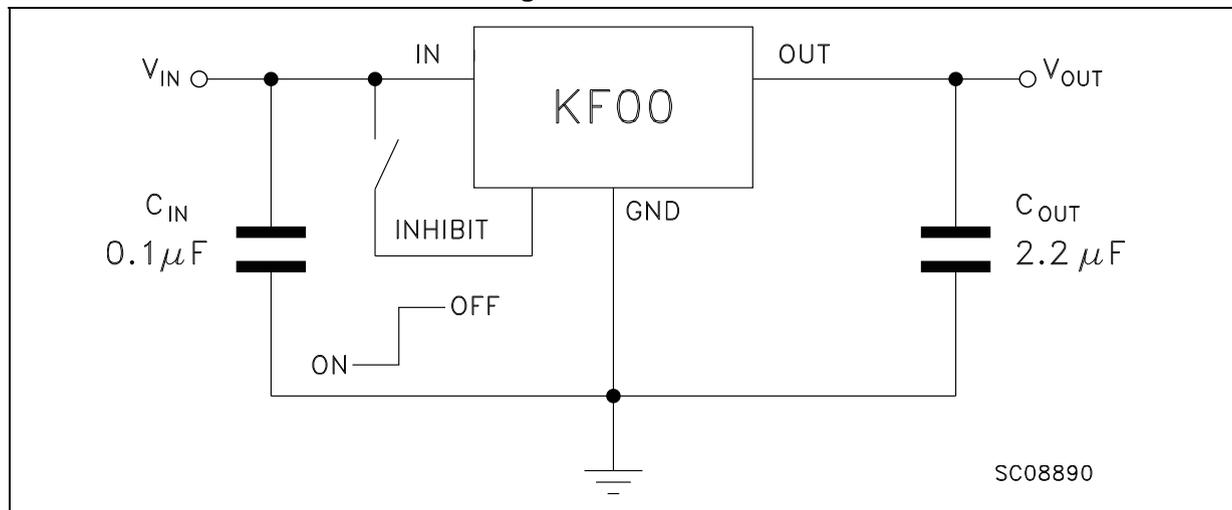
| Symbol    | Parameter                            | Value              | Unit |
|-----------|--------------------------------------|--------------------|------|
| $V_I$     | DC input voltage                     | - 0.5 to 20        | V    |
| $I_O$     | Output current                       | Internally Limited |      |
| $P_{TOT}$ | Power dissipation                    | Internally Limited |      |
| $T_{STG}$ | Storage temperature range            | - 40 to 150        | °C   |
| $T_{OP}$  | Operating junction temperature range | - 40 to 125        | °C   |

Note: Absolute maximum ratings are those values beyond which damage to the device may occur. Functional operation under these condition is not implied.

Table 3. Thermal data

| Symbol     | Parameter                           | DPAK | SO-8 | Unit |
|------------|-------------------------------------|------|------|------|
| $R_{thJC}$ | Thermal resistance junction-case    | 8    | 20   | °C/W |
| $R_{thJA}$ | Thermal resistance junction-ambient | 100  | 55   | °C/W |

Figure 3. Test circuit



## 4 Electrical characteristics

Refer to the test circuits,  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_I = 0.1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$  unless otherwise specified.

**Table 4. Electrical characteristics ( $V_O = 2.5\text{ V}$ )**

| Symbol       | Parameter                 | Test conditions  | Min.                | Typ. | Max. | Unit          |               |
|--------------|---------------------------|--|---------------------|------|------|---------------|---------------|
| $V_O$        | Output voltage            | $I_O = 50\text{ mA}$ , $V_I = 4.5\text{ V}$  | 2.45                | 2.5  | 2.55 | V             |               |
|              |                           | $I_O = 50\text{ mA}$ , $V_I = 4.5\text{ V}$ , $T_a = -25\text{ to }85^\circ\text{C}$ | 2.4                 |      | 2.6  |               |               |
| $V_I$        | Operating input voltage   | $I_O = 500\text{ mA}$  |                     |      | 20   | V             |               |
| $I_O$        | Output current limit      |  |                     | 1    |      | A             |               |
| $\Delta V_O$ | Line regulation           | $V_I = 3.5\text{ to }20\text{ V}$ , $I_O = 5\text{ mA}$                              |                     | 2    | 12   | mV            |               |
| $\Delta V_O$ | Load regulation           | $V_I = 3.8\text{ V}$ , $I_O = 5\text{ to }500\text{ mA}$                             |                     | 2    | 50   | mV            |               |
| $I_d$        | Quiescent current         | $V_I = 3.5\text{ to }20\text{ V}$ , $I_O = 0\text{ mA}$                              | ON MODE             |      | 0.5  | 1             | mA            |
|              |                           | $V_I = 3.8\text{ to }20\text{ V}$ , $I_O = 500\text{ mA}$                            |                     |      |      | 12            |               |
|              |                           | $V_I = 6\text{ V}$   | OFF MODE            |      | 50   | 100           | $\mu\text{A}$ |
| SVR          | Supply voltage rejection  | $I_O = 5\text{ mA}$ , $V_I = 4.5 \pm 1\text{ V}$                                     | $f = 120\text{ Hz}$ |      | 82   |               | dB            |
|              |                           |  | $f = 1\text{ kHz}$  |      | 77   |               |               |
|              |                           |  | $f = 10\text{ kHz}$ |      | 60   |               |               |
| eN           | Output noise voltage      | $B = 10\text{ Hz to }100\text{ KHz}$   |                     | 50   |      | $\mu\text{V}$ |               |
| $V_d$        | Dropout voltage           | $I_O = 200\text{ mA}$  |                     | 0.2  | 0.35 | V             |               |
|              |                           | $I_O = 500\text{ mA}$  |                     | 0.4  | 0.7  |               |               |
| $V_{IL}$     | Control input logic low   | $T_a = -40\text{ to }125^\circ\text{C}$  |                     |      | 0.8  | V             |               |
| $V_{IH}$     | Control input logic high  | $T_a = -40\text{ to }125^\circ\text{C}$  | 2                   |      |      | V             |               |
| $I_I$        | Control input current     | $V_I = 6\text{ V}$ , $V_C = 6\text{ V}$  |                     | 10   |      | $\mu\text{A}$ |               |
| $C_O$        | Output bypass capacitance | $\text{ESR} = 0.1\text{ to }10\text{ }\Omega$ , $I_O = 0\text{ to }500\text{ mA}$    | 2                   | 10   |      | $\mu\text{F}$ |               |

Refer to the test circuits,  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_I = 0.1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$  unless otherwise specified.

**Table 5. Electrical characteristics ( $V_O = 3.3\text{ V}$ )**

| Symbol       | Parameter                 | Test conditions  | Min.                | Typ. | Max.  | Unit          |    |
|--------------|---------------------------|--|---------------------|------|-------|---------------|----|
| $V_O$        | Output voltage            | $I_O = 50\text{ mA}$ , $V_I = 5.3\text{ V}$  | 3.234               | 3.3  | 3.366 | V             |    |
|              |                           | $I_O = 50\text{ mA}$ , $V_I = 5.3\text{ V}$ , $T_a = -25\text{ to }85\text{ }^\circ\text{C}$ | 3.168               |      | 3.432 |               |    |
| $V_I$        | Operating input voltage   | $I_O = 500\text{ mA}$  |                     |      | 20    | V             |    |
| $I_O$        | Output current limit      |  |                     | 1    |       | A             |    |
| $\Delta V_O$ | Line regulation           | $V_I = 4.3\text{ to }20\text{ V}$ , $I_O = 5\text{ mA}$                                      |                     | 2    | 12    | mV            |    |
| $\Delta V_O$ | Load regulation           | $V_I = 4.6\text{ V}$ , $I_O = 5\text{ to }500\text{ mA}$                                     |                     | 2    | 50    | mV            |    |
| $I_d$        | Quiescent current         | $V_I = 4.3\text{ to }20\text{ V}$ , $I_O = 0\text{ mA}$                                      | ON MODE             |      | 0.5   | 1             | mA |
|              |                           | $V_I = 4.6\text{ to }20\text{ V}$ , $I_O = 500\text{ mA}$                                    |                     |      |       |               |    |
|              |                           | $V_I = 6\text{ V}$   |                     |      |       |               |    |
| SVR          | Supply voltage rejection  | $I_O = 5\text{ mA}$ , $V_I = 5.3 \pm 1\text{ V}$   | $f = 120\text{ Hz}$ |      | 80    |               | dB |
|              |                           |  | $f = 1\text{ kHz}$  |      | 75    |               |    |
|              |                           |  | $f = 10\text{ kHz}$ |      | 60    |               |    |
| eN           | Output noise voltage      | $B = 10\text{ Hz to }100\text{ KHz}$   |                     | 50   |       | $\mu\text{V}$ |    |
| $V_d$        | Dropout voltage           | $I_O = 200\text{ mA}$  |                     | 0.2  | 0.35  | V             |    |
|              |                           | $I_O = 500\text{ mA}$  |                     | 0.4  | 0.7   |               |    |
| $V_{IL}$     | Control input logic low   | $T_a = -40\text{ to }125\text{ }^\circ\text{C}$  |                     |      | 0.8   | V             |    |
| $V_{IH}$     | Control input logic high  | $T_a = -40\text{ to }125\text{ }^\circ\text{C}$  | 2                   |      |       | V             |    |
| $I_I$        | Control input current     | $V_I = 6\text{ V}$ , $V_C = 6\text{ V}$  |                     | 10   |       | $\mu\text{A}$ |    |
| $C_O$        | Output bypass capacitance | $\text{ESR} = 0.1\text{ to }10\text{ }\Omega$ , $I_O = 0\text{ to }500\text{ mA}$            | 2                   | 10   |       | $\mu\text{F}$ |    |

Refer to the test circuits,  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_I = 0.1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$  unless otherwise specified.

**Table 6. Electrical characteristics ( $V_O = 5\text{ V}$ )**

| Symbol       | Parameter                 | Test conditions  | Min.                | Typ. | Max. | Unit          |
|--------------|---------------------------|--|---------------------|------|------|---------------|
| $V_O$        | Output voltage            | $I_O = 50\text{ mA}$ , $V_I = 7\text{ V}$  | 4.9                 | 5    | 5.1  | V             |
|              |                           | $I_O = 50\text{ mA}$ , $V_I = 7\text{ V}$ , $T_a = -25\text{ to }85\text{ }^\circ\text{C}$ | 4.8                 |      | 5.2  |               |
| $V_I$        | Operating input voltage   | $I_O = 500\text{ mA}$  |                     |      | 20   | V             |
| $I_O$        | Output current limit      |  |                     | 1    |      | A             |
| $\Delta V_O$ | Line regulation           | $V_I = 6\text{ to }20\text{ V}$ , $I_O = 5\text{ mA}$                                      |                     | 3    | 18   | mV            |
| $\Delta V_O$ | Load regulation           | $V_I = 6.3\text{ V}$ , $I_O = 5\text{ to }500\text{ mA}$                                   |                     | 2    | 50   | mV            |
| $I_d$        | Quiescent current         | $V_I = 6\text{ to }20\text{ V}$ , $I_O = 0\text{ mA}$                                      | ON MODE             | 0.5  | 1    | mA            |
|              |                           | $V_I = 6.3\text{ to }20\text{ V}$ , $I_O = 500\text{ mA}$                                  |                     |      | 12   |               |
|              |                           | $V_I = 6\text{ V}$   | OFF MODE            | 50   | 100  | $\mu\text{A}$ |
| SVR          | Supply voltage rejection  | $I_O = 5\text{ mA}$ , $V_I = 7 \pm 1\text{ V}$   | $f = 120\text{ Hz}$ | 76   |      | dB            |
|              |                           |  | $f = 1\text{ kHz}$  | 71   |      |               |
|              |                           |  | $f = 10\text{ kHz}$ | 60   |      |               |
| eN           | Output noise voltage      | $B = 10\text{ Hz to }100\text{ KHz}$   |                     | 50   |      | $\mu\text{V}$ |
| $V_d$        | Dropout voltage           | $I_O = 200\text{ mA}$  |                     | 0.2  | 0.35 | V             |
|              |                           | $I_O = 500\text{ mA}$  |                     | 0.4  | 0.7  |               |
| $V_{IL}$     | Control input logic low   | $T_a = -40\text{ to }125\text{ }^\circ\text{C}$  |                     |      | 0.8  | V             |
| $V_{IH}$     | Control input logic high  | $T_a = -40\text{ to }125\text{ }^\circ\text{C}$  | 2                   |      |      | V             |
| $I_I$        | Control input current     | $V_I = 6\text{ V}$ , $V_C = 6\text{ V}$  |                     | 10   |      | $\mu\text{A}$ |
| $C_O$        | Output bypass capacitance | $\text{ESR} = 0.1\text{ to }10\text{ }\Omega$ , $I_O = 0\text{ to }500\text{ mA}$          | 2                   | 10   |      | $\mu\text{F}$ |

Refer to the test circuits,  $T_J = 25\text{ }^\circ\text{C}$ ,  $C_I = 0.1\text{ }\mu\text{F}$ ,  $C_O = 2.2\text{ }\mu\text{F}$  unless otherwise specified.

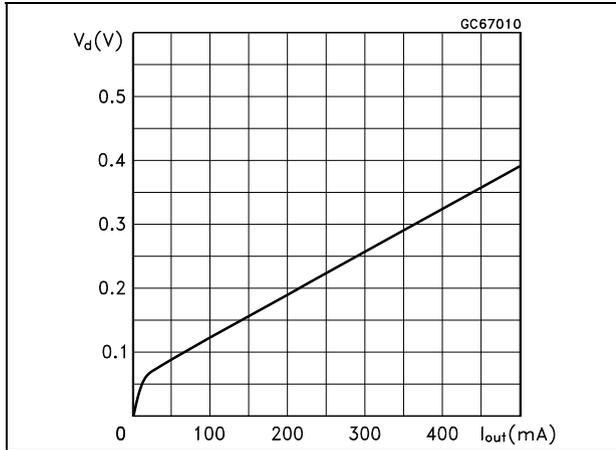
**Table 7. Electrical characteristics ( $V_O = 8\text{ V}$ )**

| Symbol       | Parameter                 | Test conditions   | Min.                | Typ. | Max. | Unit          |
|--------------|---------------------------|---|---------------------|------|------|---------------|
| $V_O$        | Output voltage            | $I_O = 50\text{ mA}$ , $V_I = 10\text{ V}$  | 7.84                | 8    | 8.16 | V             |
|              |                           | $I_O = 50\text{ mA}$ , $V_I = 10\text{ V}$ , $T_a = -25\text{ to }85\text{ }^\circ\text{C}$ | 7.68                |      | 8.32 |               |
| $V_I$        | Operating input voltage   | $I_O = 500\text{ mA}$   |                     |      | 20   | V             |
| $I_O$        | Output current limit      |   |                     | 1    |      | A             |
| $\Delta V_O$ | Line regulation           | $V_I = 9\text{ to }20\text{ V}$ , $I_O = 5\text{ mA}$                                       |                     | 4    | 24   | mV            |
| $\Delta V_O$ | Load regulation           | $V_I = 9.3\text{ V}$ , $I_O = 5\text{ to }500\text{ mA}$                                    |                     | 2    | 50   | mV            |
| $I_d$        | Quiescent current         | $V_I = 9\text{ to }20\text{ V}$ , $I_O = 0\text{ mA}$                                       | ON MODE             | 0.7  | 1.5  | mA            |
|              |                           | $V_I = 9.3\text{ to }20\text{ V}$ , $I_O = 500\text{ mA}$                                   |                     |      | 12   |               |
|              |                           | $V_I = 9\text{ V}$  | OFF MODE            | 70   | 140  | $\mu\text{A}$ |
| SVR          | Supply voltage rejection  | $I_O = 5\text{ mA}$ , $V_I = 10 \pm 1\text{ V}$   | $f = 120\text{ Hz}$ | 72   |      | dB            |
|              |                           |   | $f = 1\text{ kHz}$  | 67   |      |               |
|              |                           |   | $f = 10\text{ kHz}$ | 60   |      |               |
| eN           | Output noise voltage      | $B = 10\text{ Hz to }100\text{ KHz}$  |                     | 50   |      | $\mu\text{V}$ |
| $V_d$        | Dropout voltage           | $I_O = 200\text{ mA}$   |                     | 0.2  | 0.35 | V             |
|              |                           | $I_O = 500\text{ mA}$   |                     | 0.4  | 0.7  |               |
| $V_{IL}$     | Control input logic low   | $T_a = -40\text{ to }125\text{ }^\circ\text{C}$   |                     |      | 0.8  | V             |
| $V_{IH}$     | Control input logic high  | $T_a = -40\text{ to }125\text{ }^\circ\text{C}$   | 2                   |      |      | V             |
| $I_I$        | Control input current     | $V_I = 6\text{ V}$ , $V_C = 6\text{ V}$   |                     | 10   |      | $\mu\text{A}$ |
| $C_O$        | Output bypass capacitance | $\text{ESR} = 0.1\text{ to }10\text{ }\Omega$ , $I_O = 0\text{ to }500\text{ mA}$           | 2                   | 10   |      | $\mu\text{F}$ |

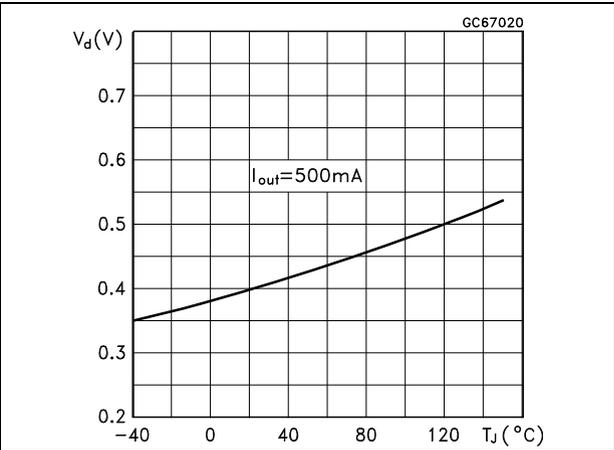
# 5 Typical performance characteristics

Unless otherwise specified  $V_{O(NOM)} = 3.3\text{ V}$ .

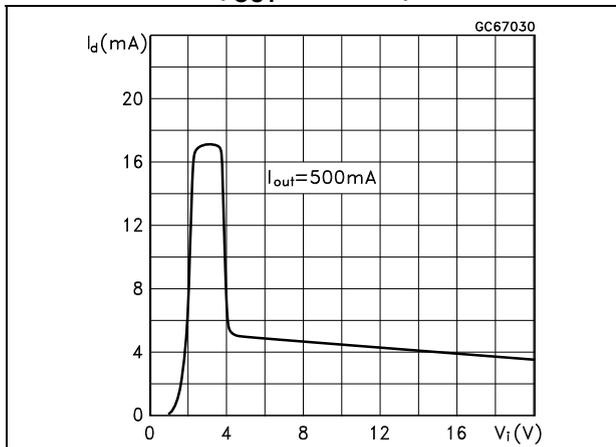
**Figure 4. Dropout voltage vs. output current**



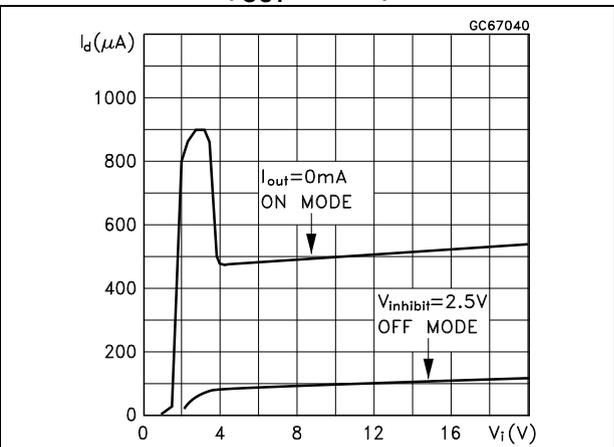
**Figure 5. Dropout voltage vs. temperature**



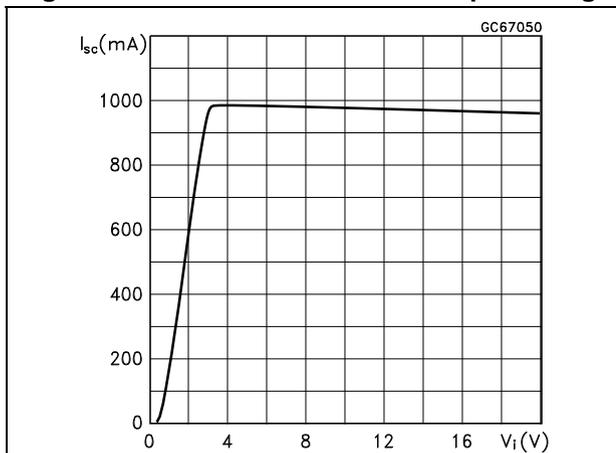
**Figure 6. Supply current vs. input voltage ( $I_{OUT} = 500\text{ mA}$ )**



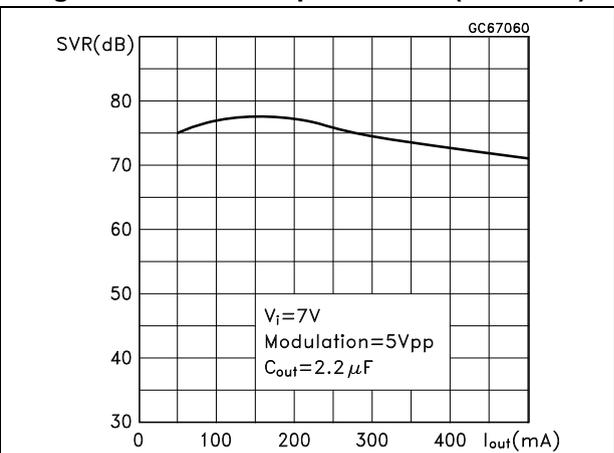
**Figure 7. Supply current vs. input voltage ( $I_{OUT} = 0\text{ mA}$ )**



**Figure 8. Short circuit current vs. input voltage**



**Figure 9. SVR vs. output current ( $f = 120\text{ Hz}$ )**



## 6 Package mechanical data

In order to meet environmental requirements, ST offers these devices in different grades of ECOPACK<sup>®</sup> packages, depending on their level of environmental compliance. ECOPACK<sup>®</sup> specifications, grade definitions and product status are available at: [www.st.com](http://www.st.com). ECOPACK<sup>®</sup> is an ST trademark.

Figure 10. DPAK (TO-252) type A drawing

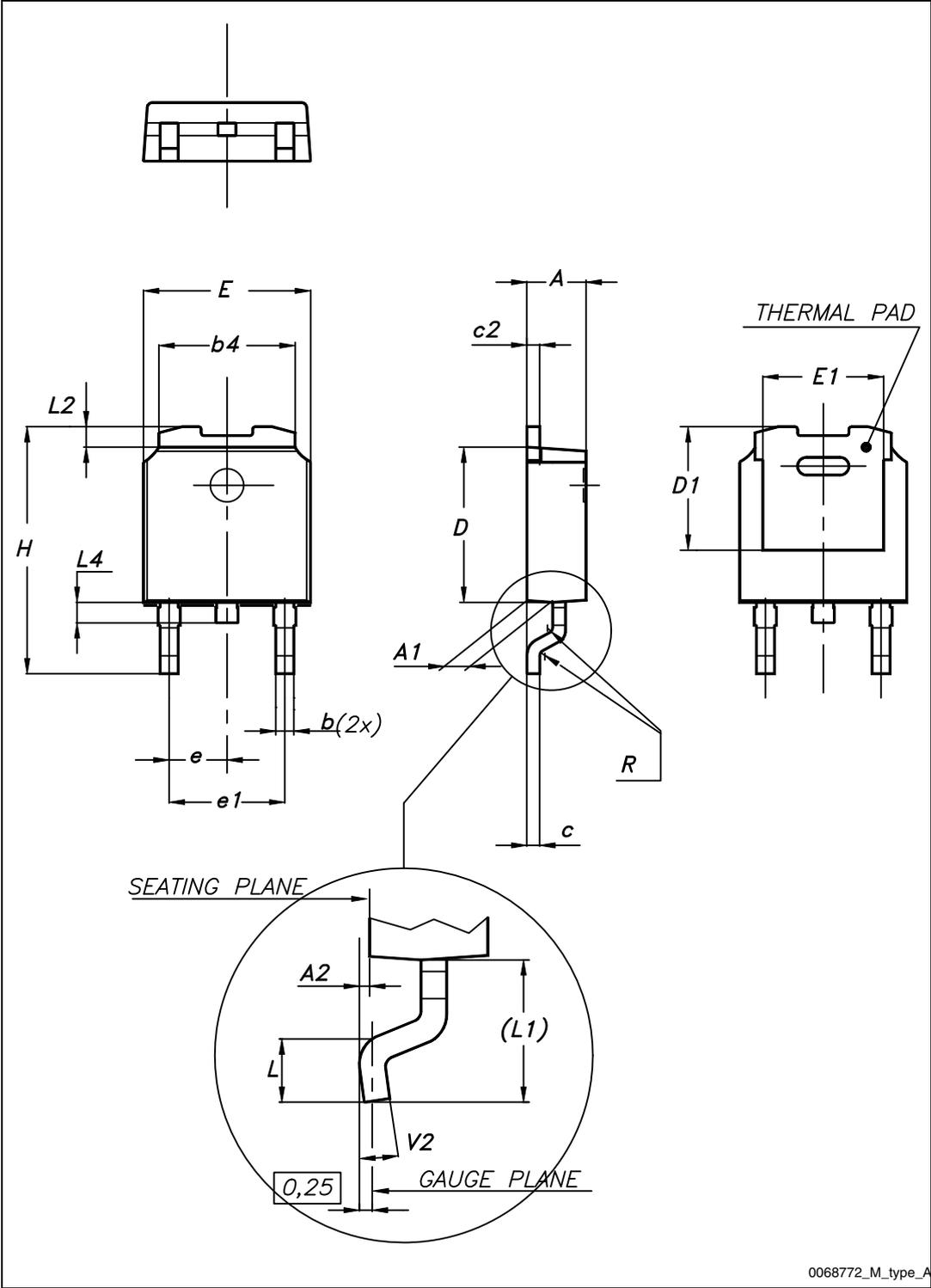
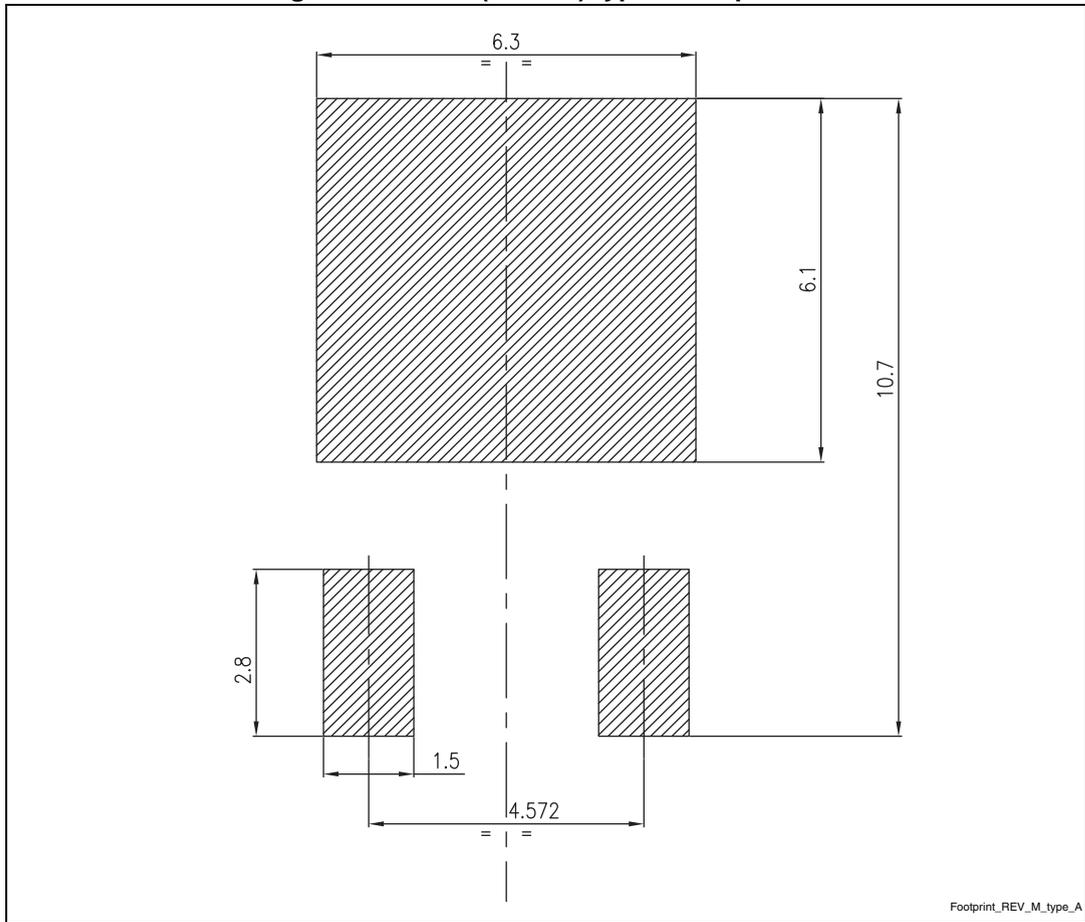


Table 8. DPAK (TO-252) type A mechanical data

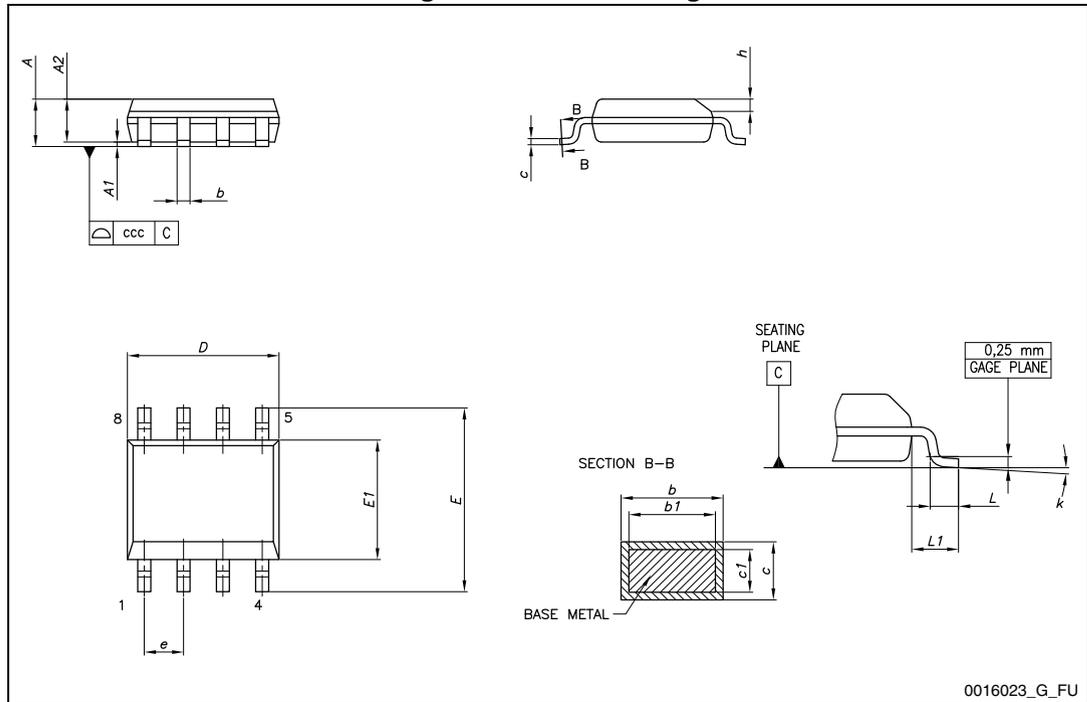
| Dim. | mm   |      |       |
|------|------|------|-------|
|      | Min. | Typ. | Max.  |
| A    | 2.20 |      | 2.40  |
| A1   | 0.90 |      | 1.10  |
| A2   | 0.03 |      | 0.23  |
| b    | 0.64 |      | 0.90  |
| b4   | 5.20 |      | 5.40  |
| c    | 0.45 |      | 0.60  |
| c2   | 0.48 |      | 0.60  |
| D    | 6.00 |      | 6.20  |
| D1   |      | 5.10 |       |
| E    | 6.40 |      | 6.60  |
| E1   |      | 4.70 |       |
| e    |      | 2.28 |       |
| e1   | 4.40 |      | 4.60  |
| H    | 9.35 |      | 10.10 |
| L    | 1.00 |      | 1.50  |
| (L1) |      | 2.80 |       |
| L2   |      | 0.80 |       |
| L4   | 0.60 |      | 1.00  |
| R    |      | 0.20 |       |
| V2   | 0°   |      | 8°    |

Figure 11. DPAK (TO-252) type A footprint (a)



a. All dimensions are in millimeters

Figure 12. SO-8 drawing



0016023\_G\_FU

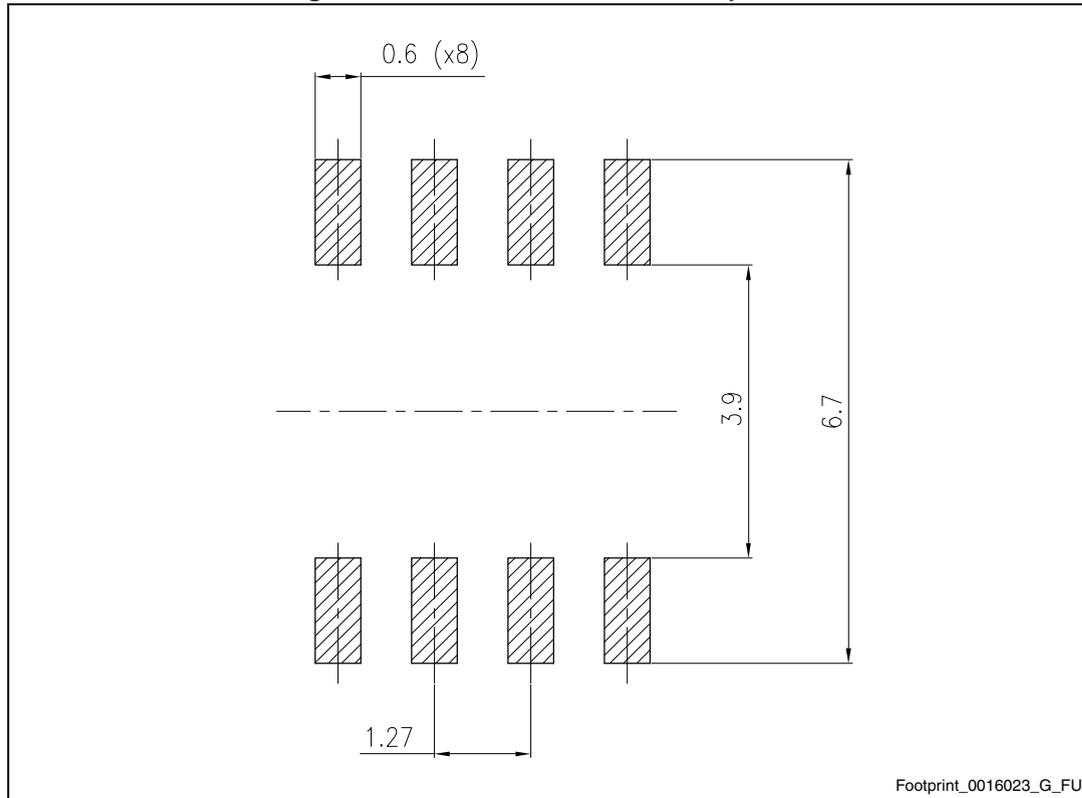
Table 9. SO-8 mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      |      | 1.75 |
| A1   | 0.10 |      | 0.25 |
| A2   | 1.25 |      |      |
| b    | 0.31 |      | 0.51 |
| b1   | 0.28 |      | 0.48 |
| c    | 0.10 |      | 0.25 |
| c1   | 0.10 |      | 0.23 |
| D    | 4.80 | 4.90 | 5.00 |
| E    | 5.80 | 6.00 | 6.20 |
| E1   | 3.80 | 3.90 | 4.00 |
| e    |      | 1.27 |      |
| h    | 0.25 |      | 0.50 |
| L    | 0.40 |      | 1.27 |
| L1   |      | 1.04 |      |
| L2   |      | 0.25 |      |

Table 9. SO-8 mechanical data (continued)

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| k    | 0°   |      | 8°   |
| ccc  |      |      | 0.10 |

Figure 13. SO-8 recommended footprint<sup>(b)</sup>



Footprint\_0016023\_G\_FU

b. All dimensions are in millimeters.

# 7 Packaging mechanical data

Figure 14. Tape for DPAK (TO-252)

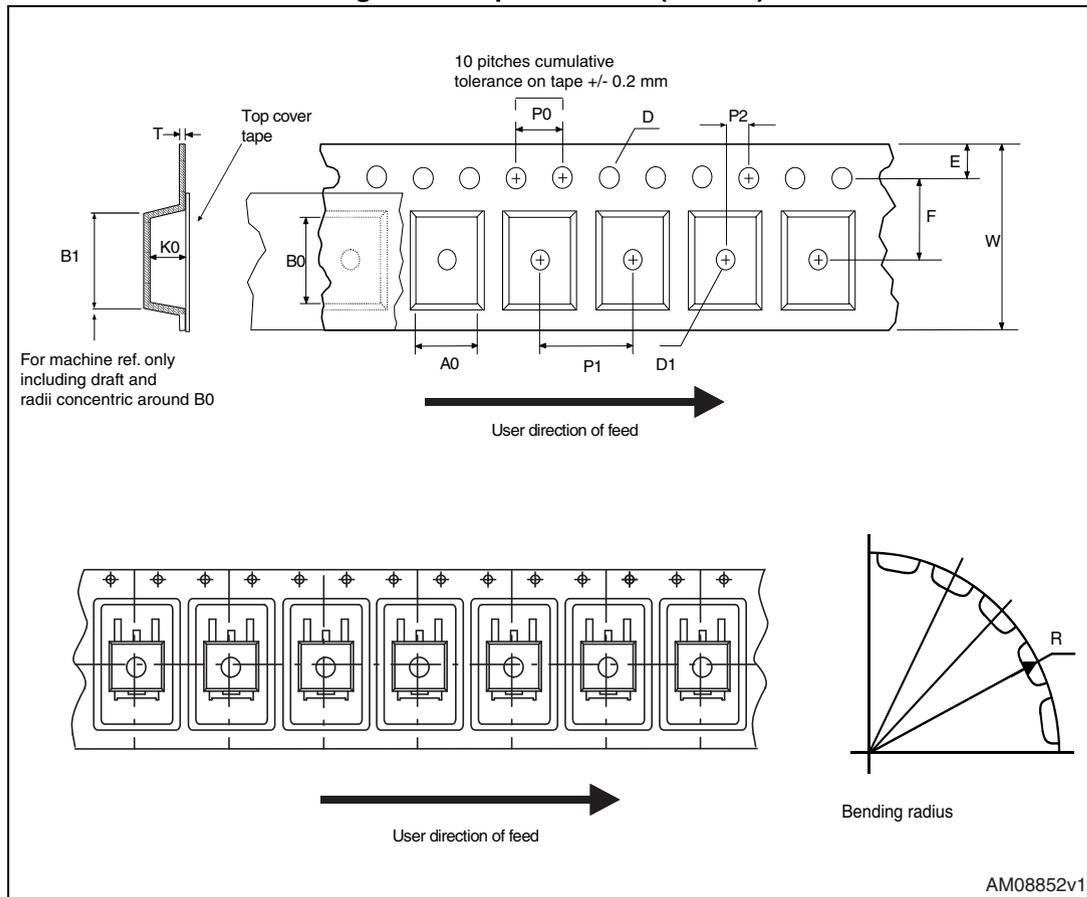


Figure 15. Reel for DPAK (TO-252)

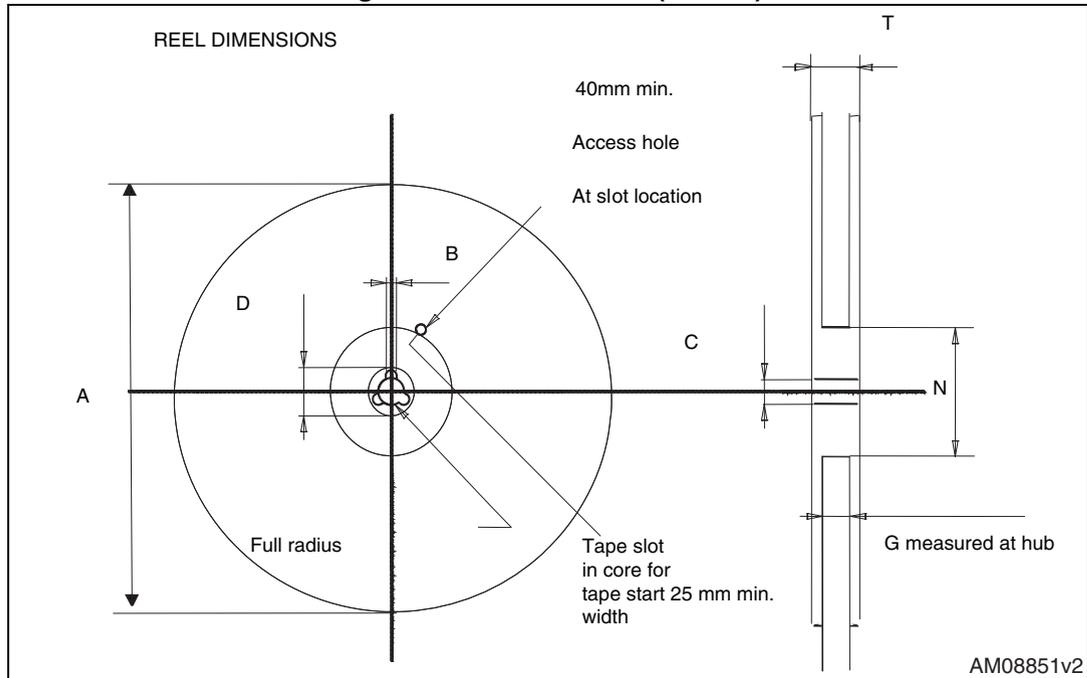


Table 10. DPAK (TO-252) tape and reel mechanical data

| Tape |      |      | Reel |           |      |
|------|------|------|------|-----------|------|
| Dim. | mm   |      | Dim. | mm        |      |
|      | Min. | Max. |      | Min.      | Max. |
| A0   | 6.8  | 7    | A    |           | 330  |
| B0   | 10.4 | 10.6 | B    | 1.5       |      |
| B1   |      | 12.1 | C    | 12.8      | 13.2 |
| D    | 1.5  | 1.6  | D    | 20.2      |      |
| D1   | 1.5  |      | G    | 16.4      | 18.4 |
| E    | 1.65 | 1.85 | N    | 50        |      |
| F    | 7.4  | 7.6  | T    |           | 22.4 |
| K0   | 2.55 | 2.75 |      |           |      |
| P0   | 3.9  | 4.1  |      | Base qty. | 2500 |
| P1   | 7.9  | 8.1  |      | Bulk qty. | 2500 |
| P2   | 1.9  | 2.1  |      |           |      |
| R    | 40   |      |      |           |      |
| T    | 0.25 | 0.35 |      |           |      |
| W    | 15.7 | 16.3 |      |           |      |

Figure 16. SO-8 tape and reel dimensions

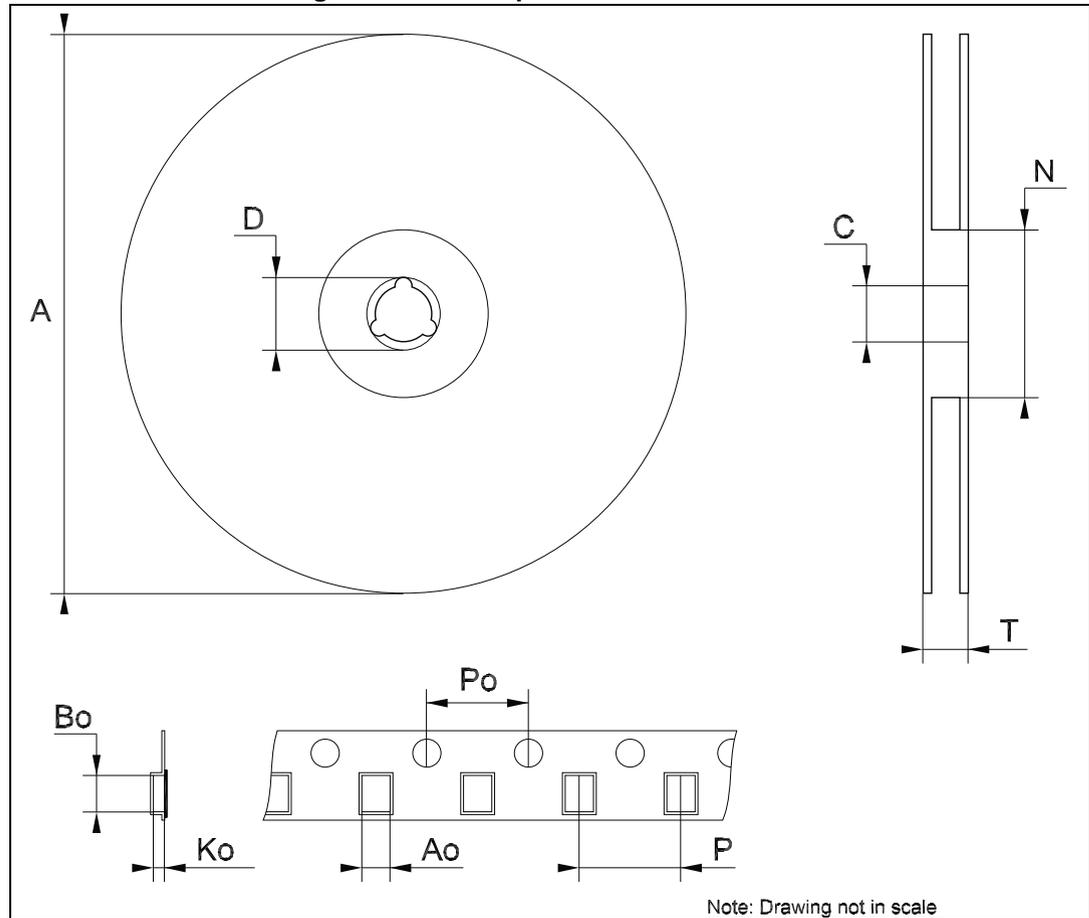


Table 11. SO-8 tape and reel mechanical data

| Dim. | mm   |      |      |
|------|------|------|------|
|      | Min. | Typ. | Max. |
| A    |      |      | 330  |
| C    | 12.8 |      | 13.2 |
| D    | 20.2 |      |      |
| N    | 60   |      |      |
| T    |      |      | 22.4 |
| Ao   | 8.1  |      | 8.5  |
| Bo   | 5.5  |      | 5.9  |
| Ko   | 2.1  |      | 2.3  |
| Po   | 3.9  |      | 4.1  |
| P    | 7.9  |      | 8.1  |

## 8 Revision history

**Table 12. Document revision history**

| Date        | Revision | Changes  |
|-------------|----------|--|
| 06-Jun-2007 | 9        | Order codes updated.   |
| 14-Dec-2007 | 10       | Modified: Table 1.   |
| 21-Feb-2008 | 11       | Modified: Table 1.   |
| 23-Oct-2012 | 12       | Change title description in cover page.<br>Updated: Table 1 on page 1.<br>Added: $R_{thJA}$ value for DPAK and SO-8 Table 3 on page 5.<br>Modified: titles Figure 6 and Figure 7 on page 10. |
| 19-Mar-2014 | 13       | The part numbers KF25B, KF33B, KF50B, KF80B changed to KF.<br>Updated Section 6: Package mechanical data and Section 7: Packaging mechanical data.<br>Minor text changes.                    |
| 16-Feb-2018 | 14       | Minor text changes.  |

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